Information Retrieval Visualization

CPSC 533c Class Presentation

Qixing Zheng

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Purpose of Information Retrieval (IR)

"The purpose of information retrieval is to help users effectively access large collections of objects with the goal of satisfying users' stated information needs."

-- W. Bruce Croft

Too Few or Too Many

- **Your Search:**{collaborative};{visualization};{tool}
  Search Results: Records found: **2** / Total characters: **5667**

- **Your Search:**{collaborative,visualization,tool}
  Search Results: Records found: **3213** / Total characters: **4000286**

The Search Results…

```
image network

This is a searchable index.  Enter search keywords: [          ]

Index conf.announce contains the following 164 items relevar
'image network'.  The first figure for each entry is its rel
score, the second the number of lines in the item.

* 1000 1190 /ftp/pub/conf.announce/jenc5
* 886 125 /ftp/pub/conf.announce/image.processing.conf
* 800 334 /ftp/pub/conf.announce/image.analysis.symposium
* 743 303 /ftp/pub/conf.announce/sans-III
* 543 376 /ftp/pub/conf.announce/atnac.94
* 486 133 /ftp/pub/conf.announce/sid
* 486 125 /ftp/pub/conf.announce/qes2
* 457 138 /ftp/pub/conf.announce/europen.forum.94
* 429 378 /ftp/pub/conf.announce/mva.94
* 429 785 /ftp/pub/conf.announce/openview.conf
* 429 104 /ftp/pub/conf.announce/high.performance.networking
* 400 217 /ftp/pub/conf.announce/nonlinear.signal.workshop
* 429 378 /ftp/pub/conf.announce/vision.interface.94
* 429 785 /ftp/pub/conf.announce/inet.94
* 429 104 /ftp/pub/conf.announce/icmcs.94
* 400 217 /ftp/pub/conf.announce/internetworking.94
* 371 220 /ftp/pub/conf.announce/iss.95
* 371 168 /ftp/pub/conf.announce/qes1
* 343 152 /ftp/pub/conf.announce/conti.94
* 343 247 /ftp/pub/conf.announce/elvira
```

Outline

- Background on IR
- InfoCrystal (Spoerri, 1993)
- TileBars (Hearst, 1995)
- Evaluation of a Tool for Visualization of Information Retrieval Results (Veerasamy & Belkin, 1996)

Background on IR

- Common approaches of text retrieval
  - Boolean term specification

    e.g. information retrieval AND (query language OR human factors)

  - Similarity search: vector space model, probabilistic models, and etc.

    Rank documents according to how close they are to the terms in the query

Functionalities of IR Visualization Systems

Relationships between queries and retrieved documents

Generating Boolean Queries

Query terms distribution in the document

Search support

Keyword-based / Full text

Frequency of query terms

Transparency of Ranking

Providing overview of query words in the document space

Document length

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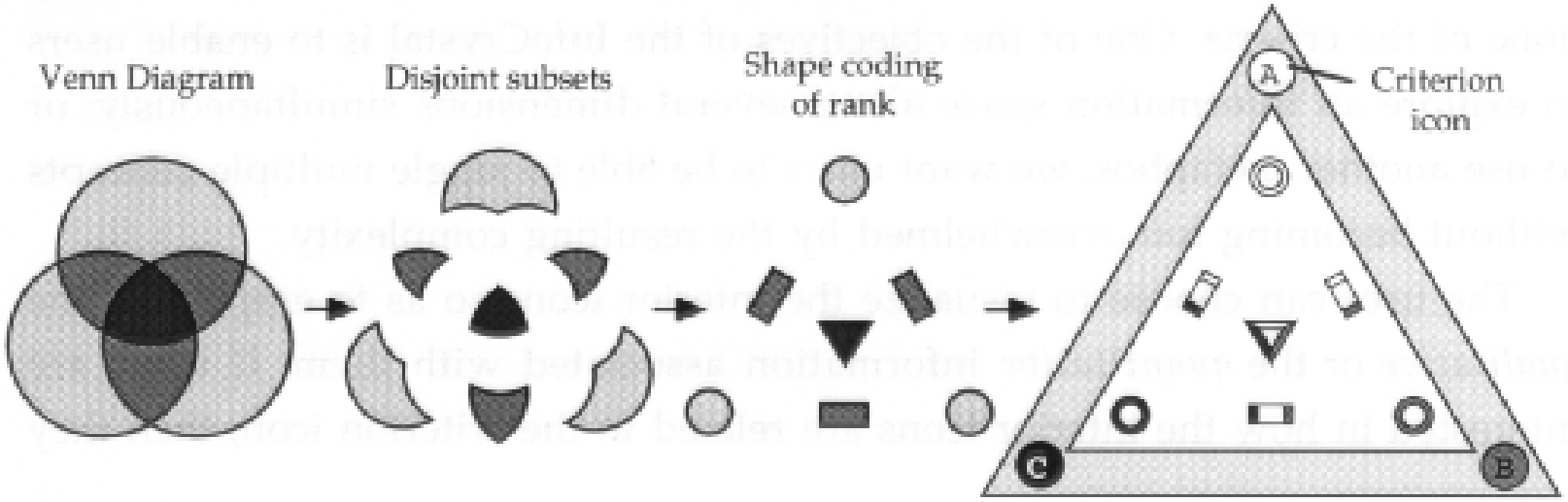
InfoCrystal Formation



Shape coding

Rank coding

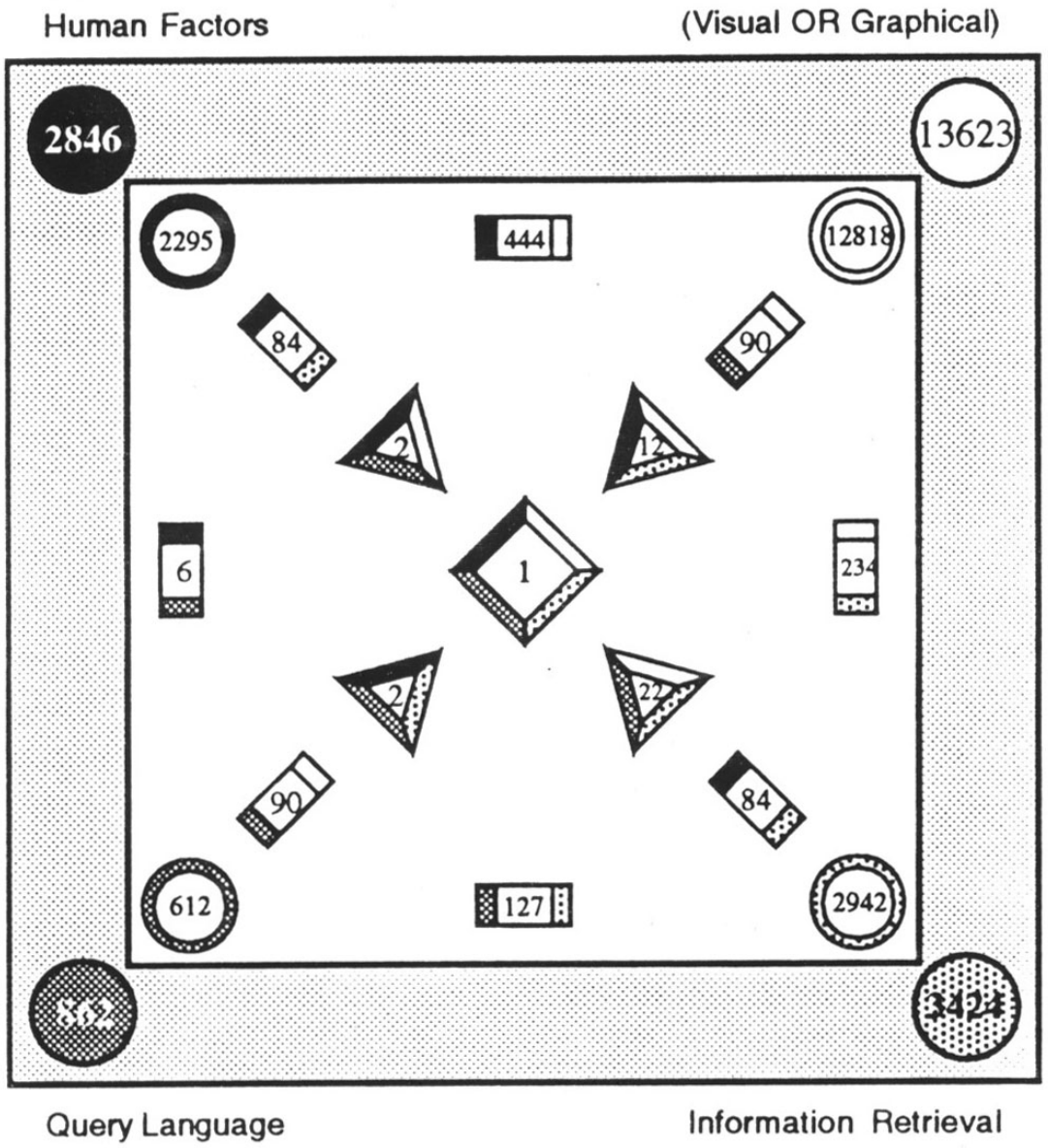
Orientation coding

Proximity coding

Color or texture coding

Size or Brightness &saturation coding

InfoCrystal



Numbers indicate the amount of documents retrieved

Ranking vs. proximity principle

Users can select relationships by clicking icons

The threshold slider

Features of InfoCrystal

- A visualization tool and a visual query language
- Visualize all the possible discrete and continuous relationships among N concepts
- User can selectively emphasize the qualitative or the quantitative information
- Users can specify Boolean and vector-space queries graphically

Functionality Check

Relationships between queries and retrieved documents

Generating Boolean Queries

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Providing overview of query words in the document space

Document length

Critique

- Pros
  - Very smart idea
  - Nice comparison with relevant previous work
- Cons
  - No user studies to test the effectiveness of the visualization
  - Concentrate on the short comings all other systems

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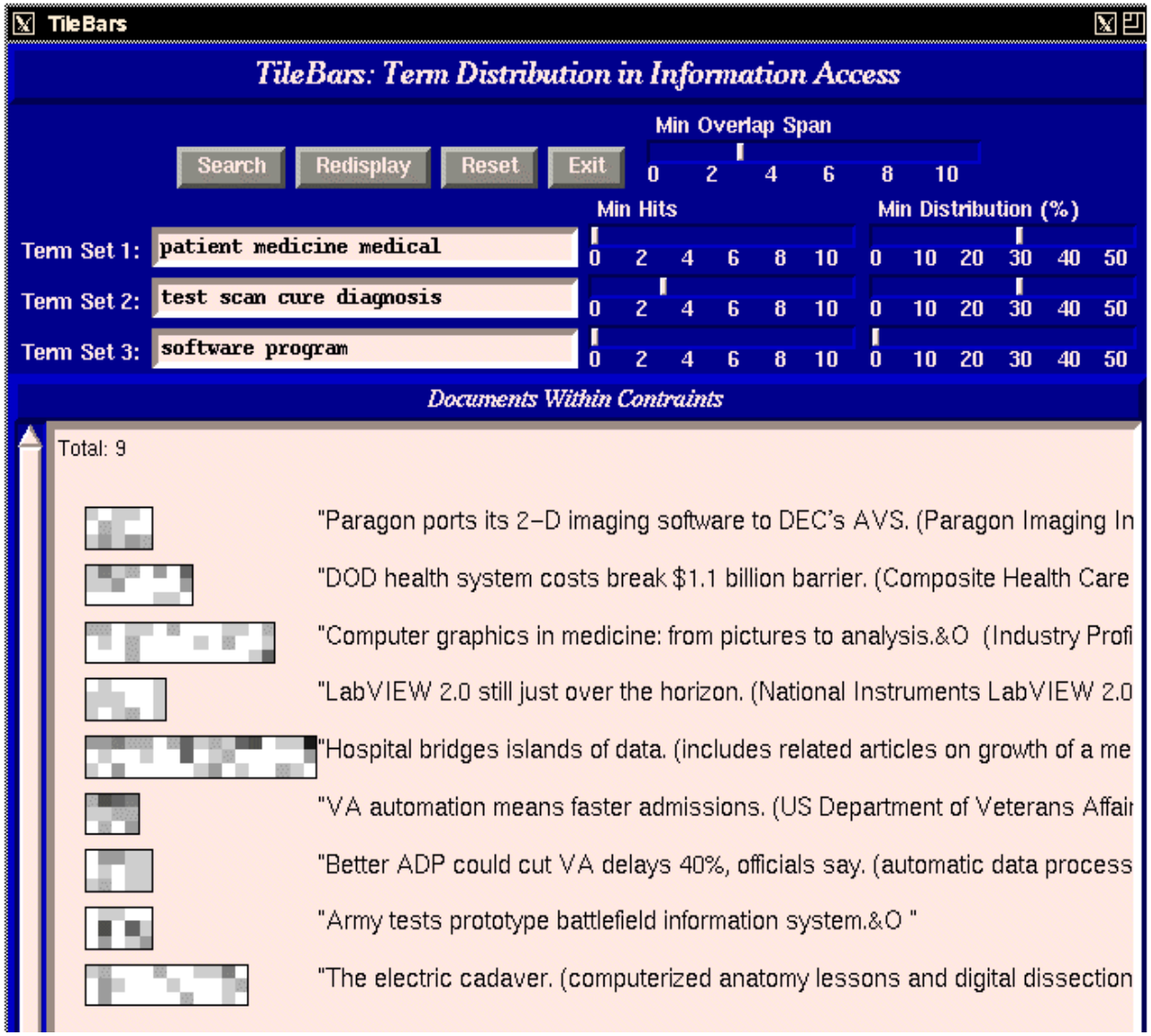
TileBars



Three Term sets

Large rectangle indicates a document

Click on a tile to see the contents of the document.

Term frequency and distribution information is important for determining relevance.

Functionality Check

Relationships between queries and retrieved documents

Generating Boolean Queries

Query terms distribution in the document

Search support

Keyword-based / Full text

Frequency of query terms

Transparency of Ranking

Providing overview of query words in the document space

Document length

Critique

- Pros
  - One of the first paper focused on long texts information access
  - Provides information on how different query facets overlap in different sections of a long document
- Cons
  - No user studies to test the effectiveness of the visualization
  - Good for long text retrieval, constrained by length

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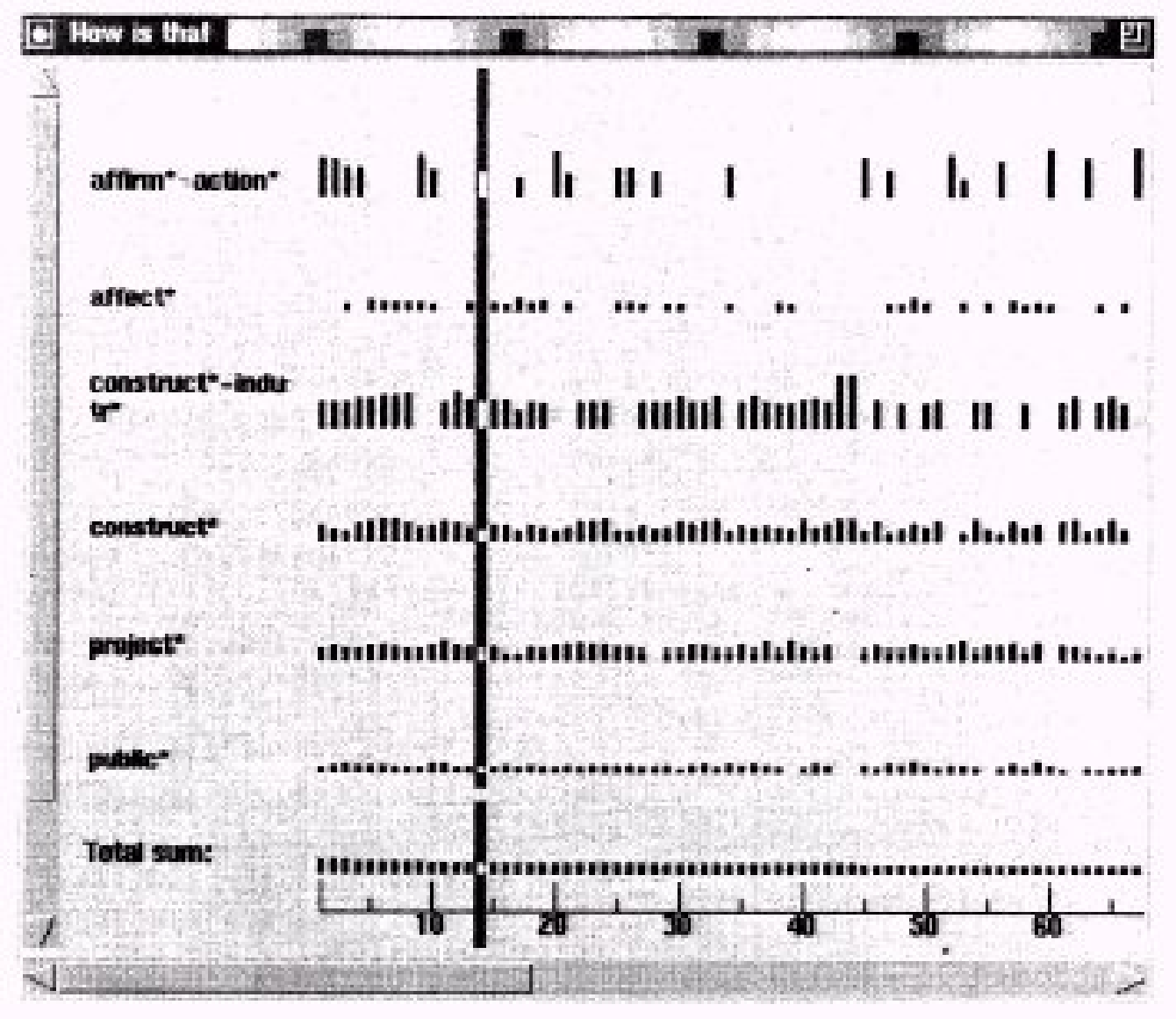
Another IR Visualization



Metrics for Evaluation

- Test effectiveness, usability, and acceptability of the visualization tool
- Prediction: the visualization tool will make better decisions about which documents to look at than those without visualization
- Parameters:
  - # of documents saved per search (s-p-s)
  - Interactive trec precision (i-t-p)
  - Interactive user precision (i-u-p)
  - Precision of the seach

Experiment 1

- 36 subjects, 3 groups
  - Group “with-out: with”
    - initial tutorial, 1st search without visualization, intermediate tutorial, 2nd search with visualization tool
  - Group with: with
  - Group without: without
- Results
  - No significant differences between any two groups in any of the four measures

Experiment 2

- 36 subjects, 2 groups
  - Group “viz”
  - Group “noviz”
- Results
  - Favor “viz” group, but not significant
  - One explanation: visualization of this sort is helpful for naïve searchers, but loses its effect when users become more experienced with the IR system

Critique

- Pros
  - Initial attempt to evaluate visualization tool for IR
  - Generate possible metrics for evaluation
- Cons
  - Many confounds in the experiment
  - No user feedback was reported
  - Did not state why the authors decided to choose the particular vis tool to evaluate

Conclusion

- How can we use visualization to help us to filter the huge information collection?
- What are the key features that make a IR visualization useful?
- How can we design better user studies to test these systems?
- Would the combination of IR visualization tools and IR intelligent agents be more powerful, and can assists users better?